AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS BIOLOGY

Unit 1 Biology and disease

Thursday 25 May 2017 Afternoon Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

Answer **all** questions in the spaces provided.

1 (a) Name the monosaccharides of which the following disaccharides are composed.

1 (a) (i) Sucrose

[1 mark]

monosaccharide 1 _____

monosaccharide 2 _____

1 (a) (ii) Lactose

[1 mark]

monosaccharide 1 _____

monosaccharide 2 _____

1 (b) Amylase and maltase are involved in the digestion of starch in the small intestine.

Complete **Table 1** by identifying where these enzymes are produced and the product of the reaction they catalyse.

[2 marks]

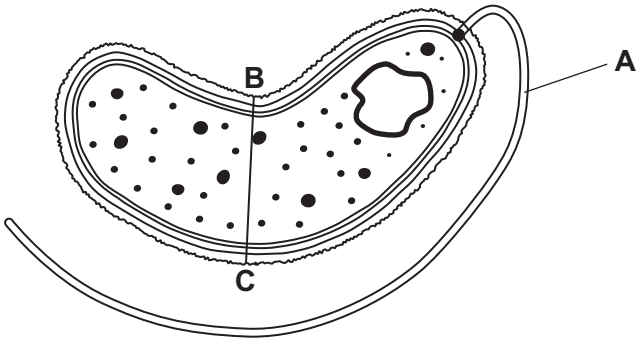
Table 1

Name of enzyme	Where the enzyme is produced	Product of the reaction catalysed by the enzyme
Amylase		
Maltase		

4

2 **Figure 1** shows a cholera bacterium. It has been magnified 50 000 times.

Figure 1



2 (a) Name **A**.

[1 mark]

_____

2 (b) Other than **A**, name **two** structures present in a cholera bacterium that are **not** present in an epithelial cell from the small intestine.

[2 marks]

1 _____

2 _____

2 (c) Calculate the actual width of the cholera bacterium between points **B** and **C**.
Give your answer in micrometres and show your working.

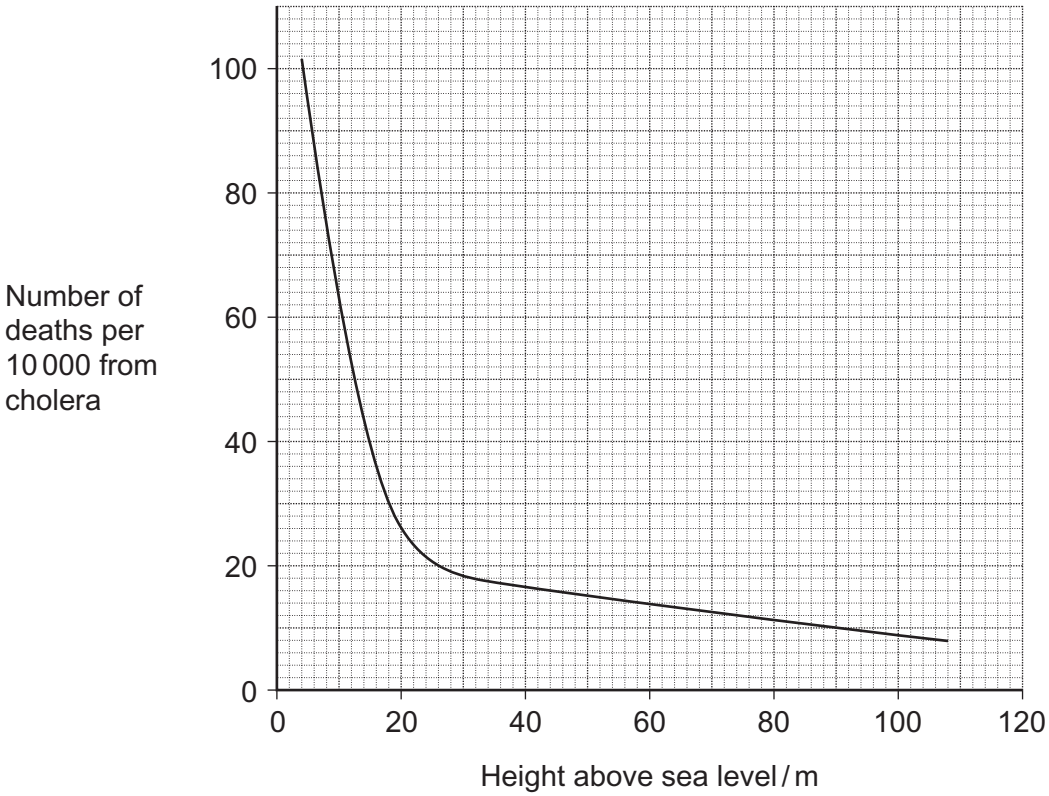
[2 marks]

_____ µm

Question 2 continues on the next page

2 (d) An outbreak of cholera occurred in London in 1849. **Figure 2** shows the relationship between the number of deaths from cholera and the height at which people lived above sea level.

Figure 2



Describe the relationship between the number of deaths from cholera and the height at which people lived above sea level.

[2 marks]

7

3 (a) Put a tick in the box next to the correct statement about the arrangement of phospholipids in a cell-surface membrane.

[1 mark]

- ☐ In a single layer, with fatty acids to the inside of the cell and phosphate groups to the outside of the cell.
- ☐ In a bilayer, with fatty acids to the outside and phosphate groups to the inside of the bilayer.
- ☐ In a bilayer, with fatty acids to the inside and phosphate groups to the outside of the bilayer.
- ☐ In a bilayer, with triglycerides to the inside and phosphate groups to the outside of the bilayer.

3 (b) Cells that secrete enzymes contain a lot of rough endoplasmic reticulum (RER) and a large Golgi apparatus.

3 (b) (i) Describe how the RER is involved in the production of enzymes.

[2 marks]

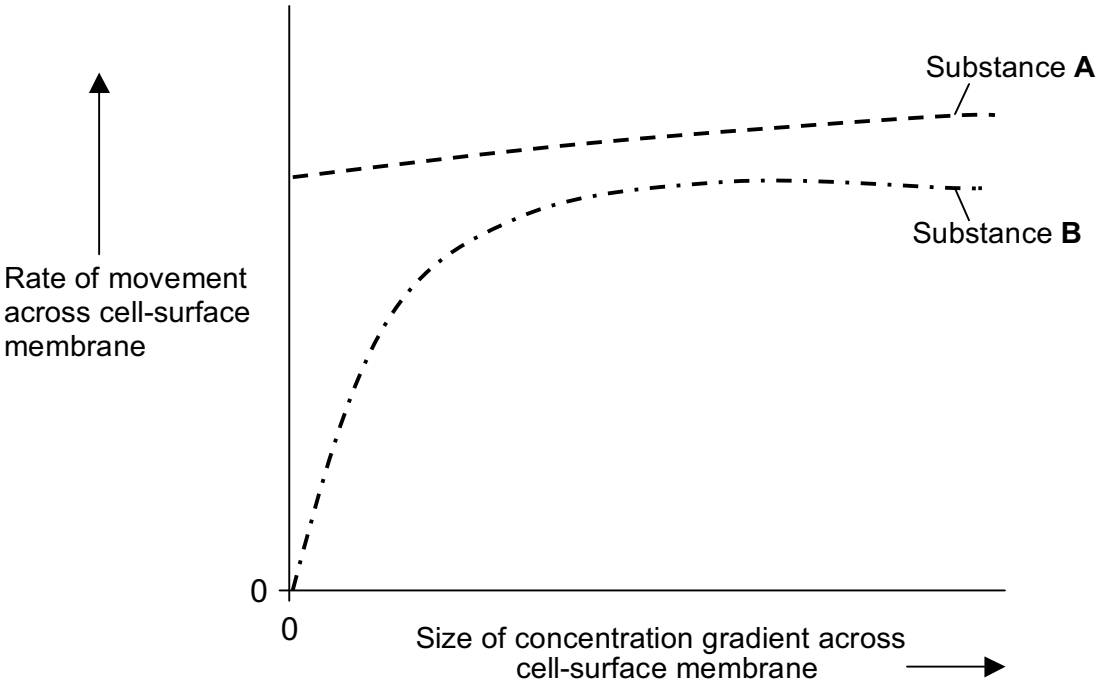
3 (b) (ii) Describe how the Golgi apparatus is involved in the secretion of enzymes.

[1 mark]

Question 3 continues on the next page

3 (c) **Figure 3** shows how the movement of two substances, **A** and **B**, across a membrane is affected by changes in their concentration gradients across the membrane.

Figure 3



3 (c) (i) Substance **A** is moved by active transport.

What is the evidence for this from **Figure 3**?

[1 mark]

3 (c) (ii) Substance **B** is moved by facilitated diffusion.

What is the evidence for this from **Figure 3**?

[2 marks]

7

4 (a) Induced fit and lock and key are two models used to explain the action of enzymes.

4 (a) (i) Describe the induced fit model of enzyme action.

[2 marks]

4 (a) (ii) Describe **one** way that the lock and key model is different from the induced fit model.

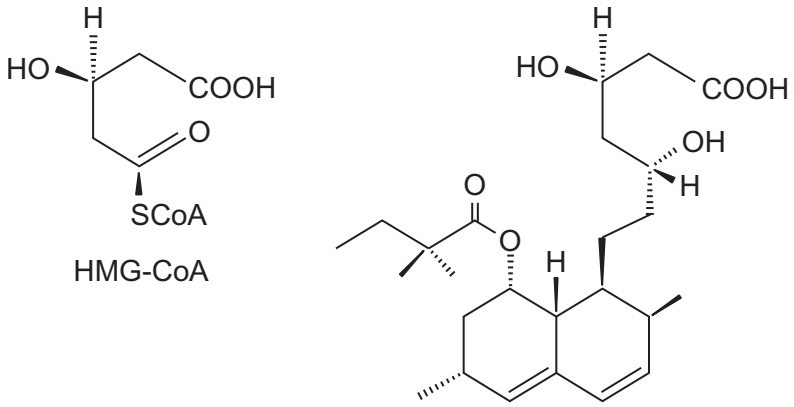
[1 mark]

Question 4 continues on the next page

4 (b) In the body, the first reaction in the production of cholesterol is catalysed by the enzyme HMG-CoA reductase. The substrate of this enzyme is HMG-CoA.

Lovastatin is a drug used to reduce a person's production of cholesterol.
Figure 4 shows the structures of molecules of HMG-CoA and Lovastatin.

Figure 4



Use **Figure 4** and your knowledge of enzymes to explain how Lovastatin reduces the production of cholesterol.

[3 marks]

6

[Extra space]

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

5 (a) (i) The human heart has four chambers.

In which **one** of the four chambers of the human heart does pressure reach the highest value?

[1 mark]

_____

5 (a) (ii) Explain how the structure of this chamber causes this high pressure.

[1 mark]

_____

_____

_____

Table 2 shows the volume of blood in a man's right ventricle at different times during one cardiac cycle.

Table 2

Time / s	Volume of blood / cm^3
0.0	125
0.1	152
0.2	99
0.3	67
0.4	53
0.5	50
0.6	96
0.7	125

5 (b) (i) Use the data in **Table 2** to calculate the man's heart rate.

[1 mark]

Heart rate = _____ beats per minute

5 (b) (ii) Use the data in **Table 2** and your answer to part **5 (b) (i)** to calculate the man's cardiac output. Show your working.

[2 marks]

Cardiac output = _____ cm^3 per minute

5 (c) Using information from **Table 2**, complete **Table 3** to show whether the valves are open or closed at each of the times shown. Write **open** or **closed** in the appropriate boxes.

[2 marks]

Table 3

Time / s	Valve between right atrium and right ventricle	Valve between right ventricle and pulmonary artery
0.2		
0.6		

7

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6 A student investigated the effect of putting cylinders cut from a potato into sodium chloride solutions of different concentration. He cut cylinders from a potato and weighed each cylinder. He then placed each cylinder in a test tube. Each test tube contained a different concentration of sodium chloride solution. He left the tubes overnight. He then removed the cylinders from the solutions and reweighed them.

6 (a) Before reweighing, the student blotted dry the outside of each cylinder.

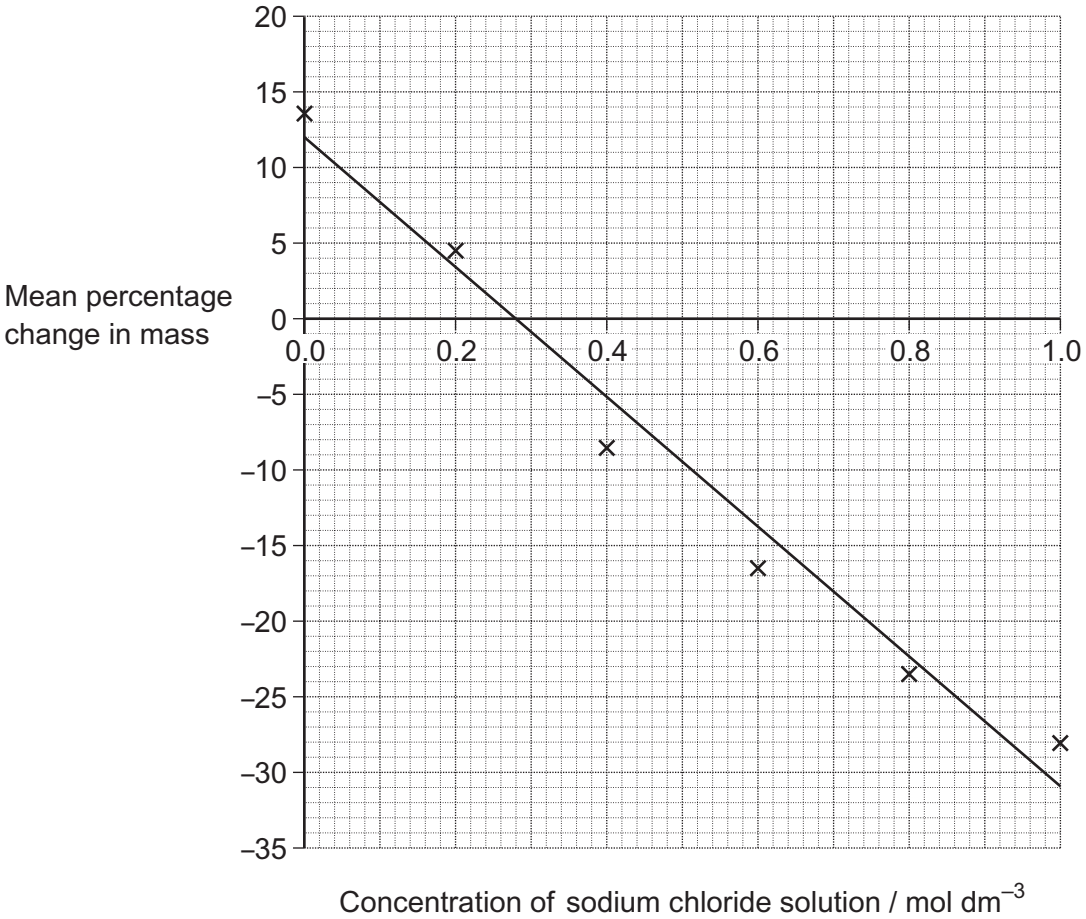
Explain why.

[2 marks]

Question 6 continues on the next page

6 (b) The student repeated the experiment several times at each concentration of sodium chloride solution. His results are shown in **Figure 5**.

Figure 5



6 (b) (i) The student made up all the sodium chloride solutions using a 1.0 mol dm^{-3} sodium chloride solution and distilled water.

Complete **Table 4** to show how he made 20 cm^3 of a 0.2 mol dm^{-3} sodium chloride solution.

[1 mark]

Table 4

Volume of 1.0 mol dm^{-3} sodium chloride solution / cm^3	Volume of distilled water / cm^3

6 (b) (ii) The student calculated the percentage change in mass rather than the change in mass.

Explain the advantage of this.

[2 marks]

6 (b) (iii) The student carried out several repeats at each concentration of sodium chloride solution.

Explain why the repeats were important.

[2 marks]

6 (b) (iv) Use **Figure 5** to find the concentration of sodium chloride solution that has the same water potential as the potato cylinders.

Explain how you reached your answer.

[2 marks]

concentration _____ mol dm^{-3}

Explanation _____

9

7 The human immunodeficiency virus (HIV) leads to the development of acquired immune deficiency syndrome (AIDS). Eventually, people with AIDS die because they are unable to produce an immune response to pathogens.

Scientists are trying to develop an effective vaccine to protect people against HIV. There are three main problems. HIV rapidly enters host cells. HIV causes the death of T cells that activate B cells. HIV shows a lot of antigenic variability.

Scientists have experimented with different types of vaccine for HIV. One type contains HIV in an inactivated form. A second type contains a strain of HIV which replicates in the body but does not kill host cells. A third type uses a different, non-pathogenic virus to carry genetic information from HIV into the person's cells. This makes the person's cells produce HIV proteins. So far, these types of vaccine have not been considered safe to use in a mass vaccination programme.

Use the information in the passage and your own knowledge to answer the following questions.

7 (a) Eventually, people with AIDS die because they are unable to produce an immune response to pathogens (lines 2–4).

Explain why this leads to death.

[3 marks]

[Extra space]

7 (b) Explain why each of the following means that a vaccine might **not** be effective against HIV.

7 (b) (i) HIV rapidly enters host cells (lines 6–7).

[2 marks]

7 (b) (ii) HIV shows a lot of antigenic variability (lines 7–8).

[2 marks]

7 (c) So far, these types of vaccine have not been considered safe to use in a mass vaccination programme (lines 10–15).

Suggest why they have **not** been considered safe.

[3 marks]

10

8 (a) Pulmonary tuberculosis is a disease of the lungs.

Describe the transmission and course of infection of pulmonary tuberculosis.

[5 marks]

[Extra space]

8 (b) Describe and explain how the lungs are adapted to allow rapid exchange of oxygen between air in the alveoli and blood in the capillaries around them.

[5 marks]

10

[Extra space]

END OF QUESTIONS

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